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Issued Date: Aug. 03, 2006

Model No.: N154I2-L02

Approval

TFT LCD Approval Specification

CMO MODEL NO.: N154I2-L02
Sharp MODEL NO.: LQ154K1LB1B

Customer : SHARP

Approved by : _____

Note :

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Approval**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver3.0	Aug.03.06	All	All	Approval specification was first issued



1. GENERAL DESCRIPTION

1.1 OVERVIEW

N154I2-L02 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1280 x 800 Wide-XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight
- WXGA (1280 x 800 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	331.2 (H) x 207.0 (V) (15.4" diagonal)	mm	(1)
Bezel Opening Area	335.0 (H) x 210.7 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.2588 (H) x 0.2588 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	343.5	344.0	344.5	mm	(1)
	Vertical(V)	221.5	222.0	222.5	mm	
	Depth(D)	-	6.2	6.5	mm	
Weight		-	540	560	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

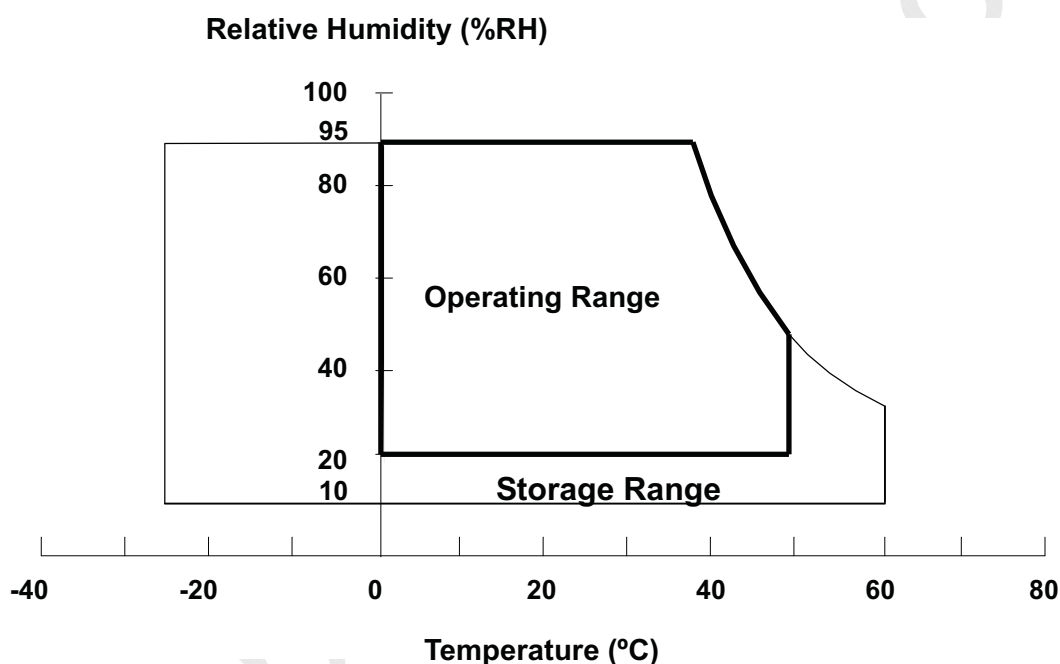
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-25	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	220G/2ms	G/ms	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

Note (1) (a) 95 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 50 °C max.

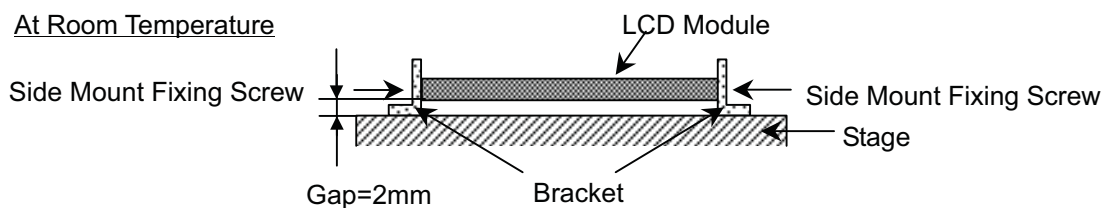


Note (3) 1 time for $\pm X, \pm Y, \pm Z$. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10~200 Hz, 0.5hr/cycle 1cycle for X,Y,Z

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:





2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	V _{CC} +0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _L	-	2.5K	V _{RMS}	(1), (2), I _L = 6.0 mA
Lamp Current	I _L	-	7.0	mA _{RMS}	
Lamp Frequency	F _L	-	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

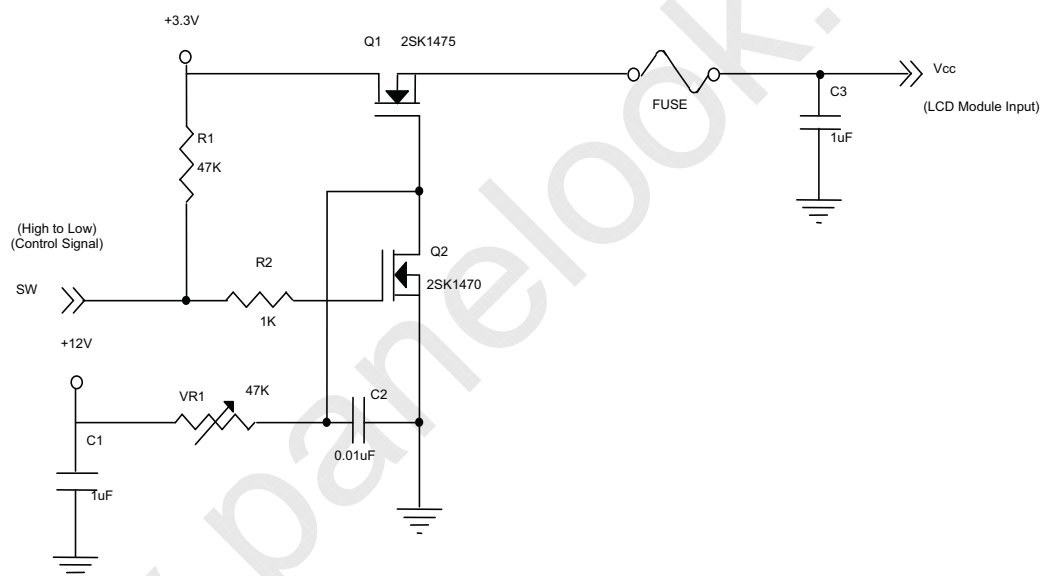
3.1 TFT LCD MODULE

 $T_a = 25 \pm 2^\circ\text{C}$

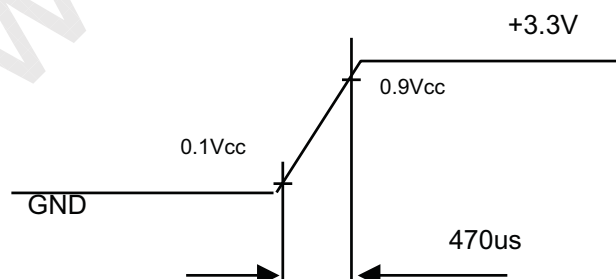
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	-
Ripple Voltage	V_{RP}	-	-	100	mV	-
Rush Current	I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current		-	330	380	mA	(3)
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	+100	mV	$V_{CM} = 1.2V(4)$
	"L" Level	V_{IL}	-100	-	mV	
Terminating Resistor	R_T	-	100	-	Ohm	-
Power per EBL WG	P_{EBL}	-	3.3	-	W	(5)

Note (1) The module should be always operated within above ranges.

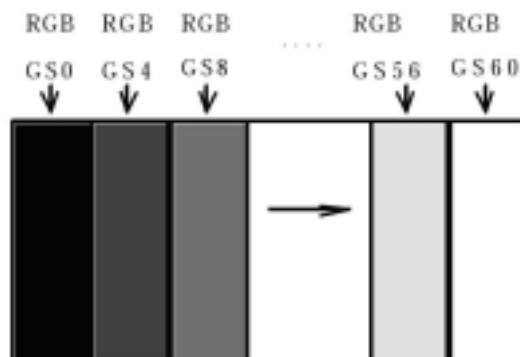
Note (2) Measurement Conditions:



Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions, Typical current situation: 16-gray-bar pattern, $V_{cc}=+3.3V$. (Maximum current situation: $V_{cc}=+3.0V$ pattern : black)



Note (4) VCM : Common mode voltage of LVDS driver.

Note (5) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

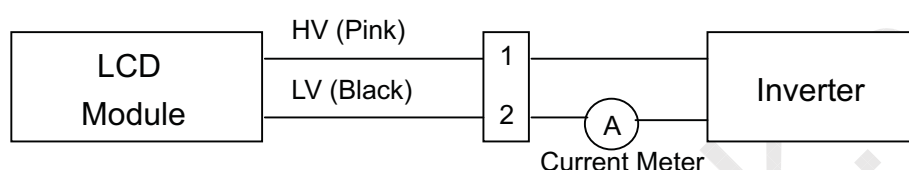
- (a) $V_{cc} = 3.3 V$, $T_a = 25 \pm 2 ^\circ C$, $f_v = 60 Hz$,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.
- (d) The inverter used is provided from Logah. Please contact Logah for detail information. CMO don't provide the inverter in this product.

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V _L	630	700	770	V _{RMS}	I _L = 6.0 mA
Lamp Current	I _L	2.0	6.0	7.0	mA _{RMS}	(1),(2)
		3.0				(1),(3)
Lamp Turn On Voltage	V _S	-	-	1140(25 °C)	V _{RMS}	(4)
		-	-	1580(0 °C)	V _{RMS}	(4)
Operating Frequency	F _L	40	-	80	KHz	(5)
Lamp Life Time	L _{BL}	12,000	-	-	Hrs	(7)
Power Consumption	P _L	-	4.2	4.62	W	(6), I _L = 6.0 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) for burst mode inverter design

Note (3) for continuous mode inverter design

Note (4) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (5) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (6) $P_L = I_L \times V_L$

Note (7) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I_L = 6.0 mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes ≤ 50% of its original value.

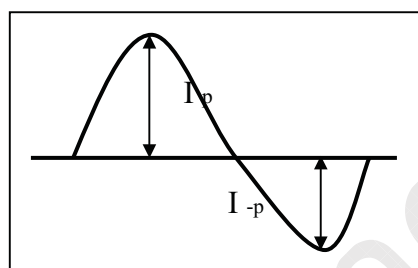
(b) When the effective ignition length becomes ≤ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform. (Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interference with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

- The asymmetry rate of the inverter waveform should be 10% below;
- The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;
- The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

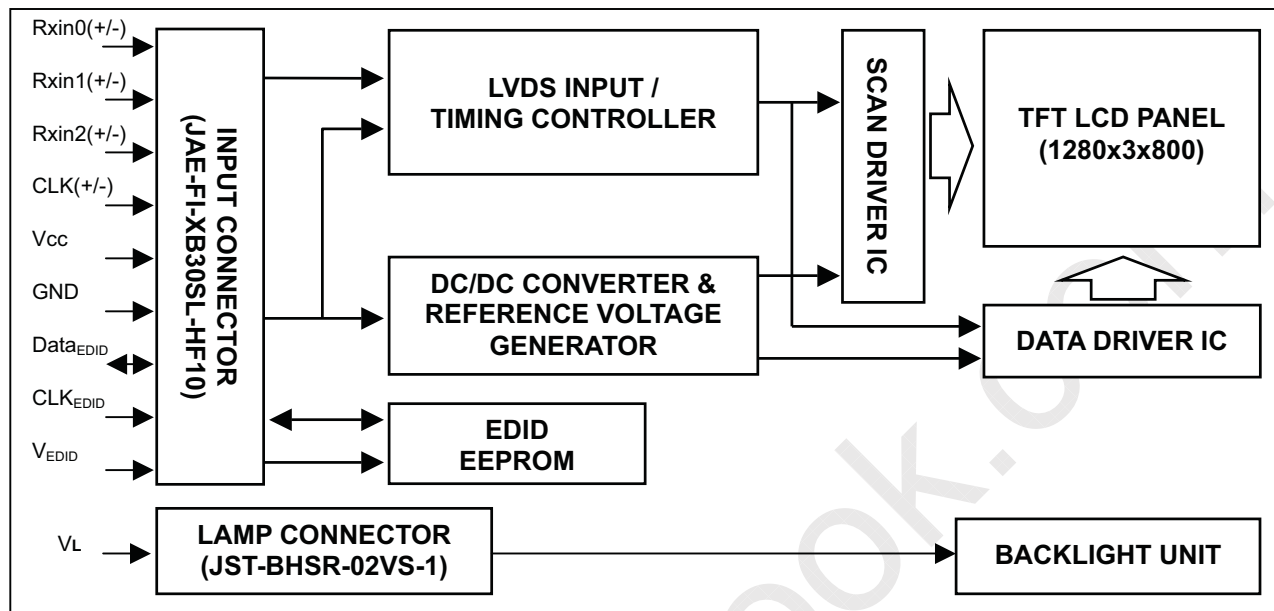
$$|I_p - I_{-p}| / I_{rms} * 100\%$$

* Distortion rate

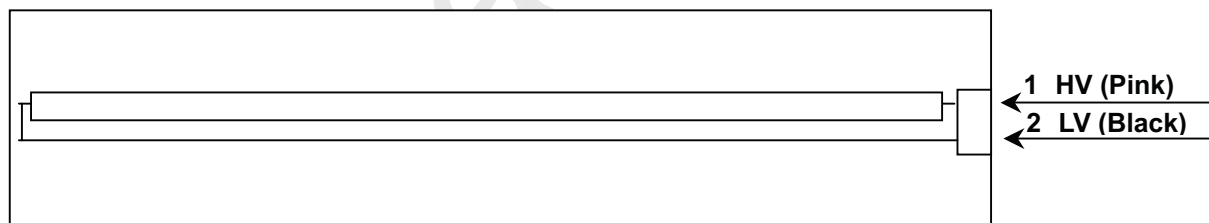
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT





5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V		-
3	Vcc	Power Supply +3.3 V		-
4	V _{EDID}	DDC +3.3 V		-
5	NC	-	-	-
6	CLK _{EDID}	DDC Clock		-
7	Data _{EDID}	DDC Data		-
8	Rxin0-	LVDS Differential Data Input	Negative	-
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		-
11	Rxin1-	LVDS Differential Data Input	Negative	-
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		-
14	Rxin2-	LVDS Differential Data Input	Negative	-
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		-
17	CLK-	LVDS Clock Data Input	Negative	-
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		-
20	NC	-	-	-
21	NC	-	-	-
22	NC	-	-	-
23	NC	-	-	-
24	NC	-	-	-
25	NC	-	-	-
26	NC	-	-	-
27	NC	-	-	-
28	NC	-	-	-
29	NC	-	-	-
30	NC	-	-	-

Note (1) Connector Part No.: JAE-FI-XB30SL-HF10 or equivalent

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent



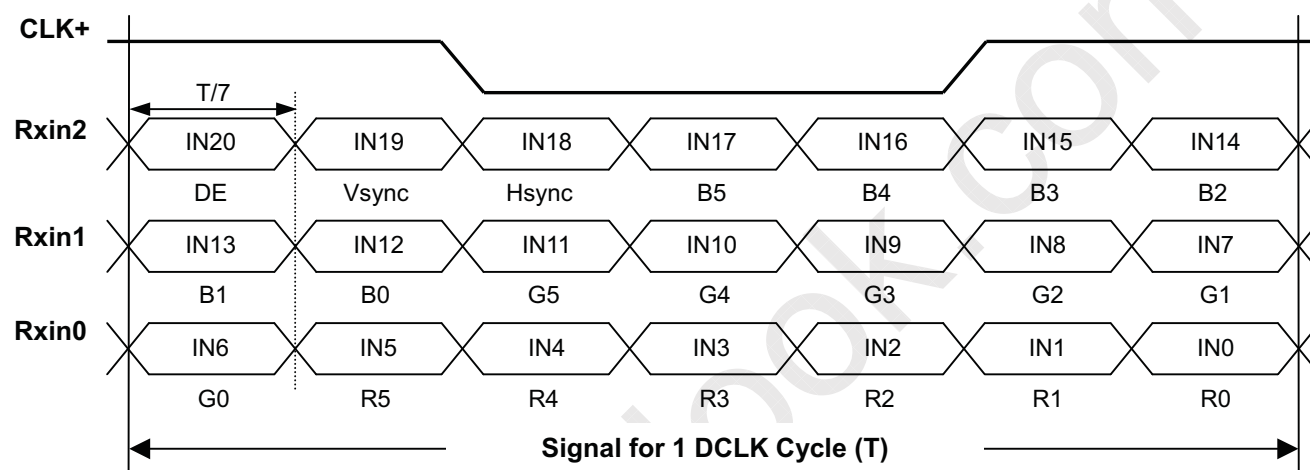
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage



5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

Byte #(decimal)	Byte #(hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA manufacture code = SHP	4D	01001101
9	9	EISA manufacture code (Compressed ASCII)	10	00010000
10	0A	Product code (LQ154K1LB1B : 5066)	CA	11001010
11	0B	Product code (hex,LSB first)	13	00010011
12	0C	LCD module Serial No (fixed "0")	00	00000000
13	0D	LCD module Serial No (fixed "0")	00	00000000
14	0E	LCD module Serial No (fixed "0")	00	00000000
15	0F	LCD module Serial No (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "0")	00	00000000
17	11	Year of manufacture - 1990 (ex 2000 - 1990 = 10) (fixed "0")	00	00000000
18	12	EDID structure version # = 1	01	00000001
19	13	EDID revision # = 3	03	00000011
20	14	Video i/p definition = Digital i/p	80	10000000
21	15	Max H image size(cm) = 33cm	21	00100001
22	16	Max V image size(cm) = 21cm	15	00010101
23	17	Display gamma (2.2×100) - 100 = 120	78	01111000
24	18	Feature support(stanby,suspend,RGB color/Prefer Time)	CA	11001010
25	19	Red/Green Low bit(RxRy/GxGy)	00	00000000
26	1A	Blue/White Low bit(BxBy/WxWy)	00	00000000
27	1B	Red X(Rx) (written value " ")	00	00000000
28	1C	Red Y(Ry) (written value " ")	00	00000000
29	1D	Green X(Gx) (written value " ")	00	00000000
30	1E	Green Y(Gy) (written value " ")	00	00000000
31	1F	Blue X(Bx) (written value " ")	00	00000000
32	20	Blue Y(By) (written value " ")	00	00000000
33	21	White X(Wx) (written value " ")	00	00000000
34	22	White Y(Wy) (written value " ")	00	00000000
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000

37	25	Established timings 3(Manufacture's reserved timing)	00	00000000
38	26	Standard timing ID1	01	00000001
39	27	Standard timing ID1	01	00000001
40	28	Standard timing ID2	01	00000001
41	29	Standard timing ID2	01	00000001
42	2A	Standard timing ID3	01	00000001
43	2B	Standard timing ID3	01	00000001
44	2C	Standard timing ID4	01	00000001
45	2D	Standard timing ID4	01	00000001
46	2E	Standard timing ID5	01	00000001
47	2F	Standard timing ID5	01	00000001
48	30	Standard timing ID6	01	00000001
49	31	Standard timing ID6	01	00000001
50	32	Standard timing ID7	01	00000001
51	33	Standard timing ID7	01	00000001
52	34	Standard timing ID8	01	00000001
53	35	Standard timing ID8	01	00000001
54	36	Detailed timing descriptor#1 fck/10000	BC	10111100
55	37	#1 fck	1B	00011011
56	38	#1 Horizontal active 1280=500h "00h"	00	00000000
57	39	#1 Horizontal blanking 160=0A0h "A0h"	A0	10100000
58	3A	#1 Horizontal active/Horizontal blanking "50h"	50	01010000
59	3B	#1 Vertical active 800=320h "20h"	20	00100000
60	3C	#1 Vertical blanking 23=17h"17h"	17	00010111
61	3D	#1 Vertical active/Vertical blanking "30h"	30	00110000
62	3E	#1 Horizontal sync , offset 48=03h"30h"	30	00110000
63	3F	#1 Horizontal sync , width 32=020h"20h"	20	00100000
64	40	#1 Vertical sync,offset / Vertical sync,width(offset=3h/width=6h)	36	00110110
65	41	#1 Horizontal sync offset/width/Vertical sync offset/width	00	00000000
66	42	#1 Horizontal image size 331mm=14Bh"4Bh"	4B	01001011
67	43	#1 Vertical image size 207mm=0CFh "CFh"	CF	11001111
68	44	#1 Horizontal image size / Vertical image size "10h"	10	00010000
69	45	Horizontal boader	00	00000000
70	46	Vertical boader	00	00000000
71	47	Flags(Non-interlaced/Horizontal polarity/Vertical polarity)	19	00011001
72	48	Detailed timing descriptor #2	00	00000000
73	49	Flag	00	00000000
74	4A	Reserved	00	00000000
75	4B	Dummy Descriptor	10	00010000
76	4C	Flag	00	00000000

80	50	4th dummy	00	00000000
----	----	-----------	----	----------

122	7A	Supplier P/N#10 (1)	31	00110001
123	7B	Supplier P/N#11 (B)	42	01000010
124	7C	Supplier P/N#12 ("Space")	20	00100000
125	7D	(If<13 char, then terminate with ASCII code 0Ah, set remaining char 20h)	0A	00001010
126	7E	Extension flag	00	00000000
127	7F	Checksum	67	01100111

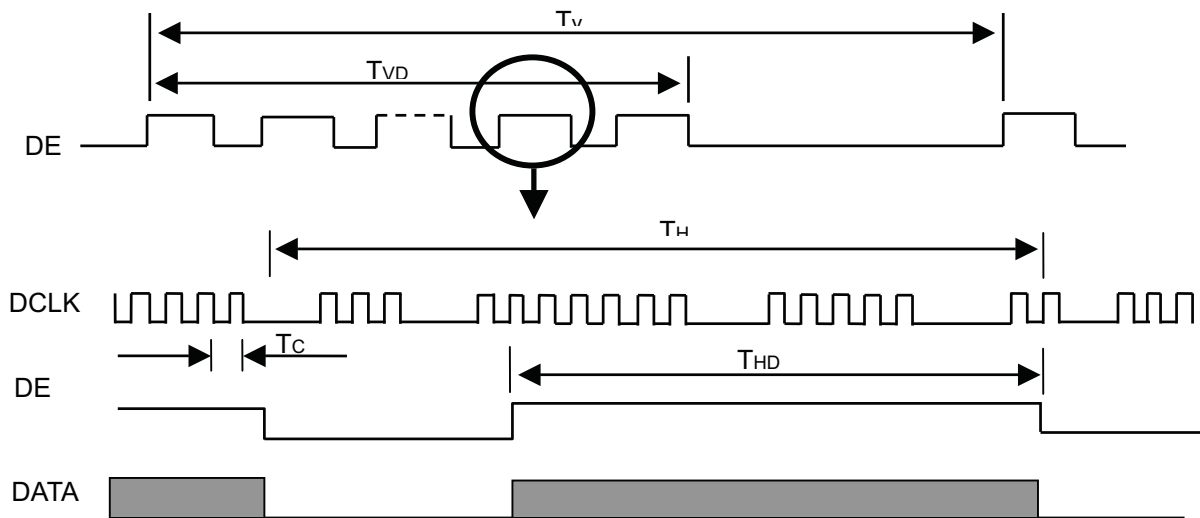
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

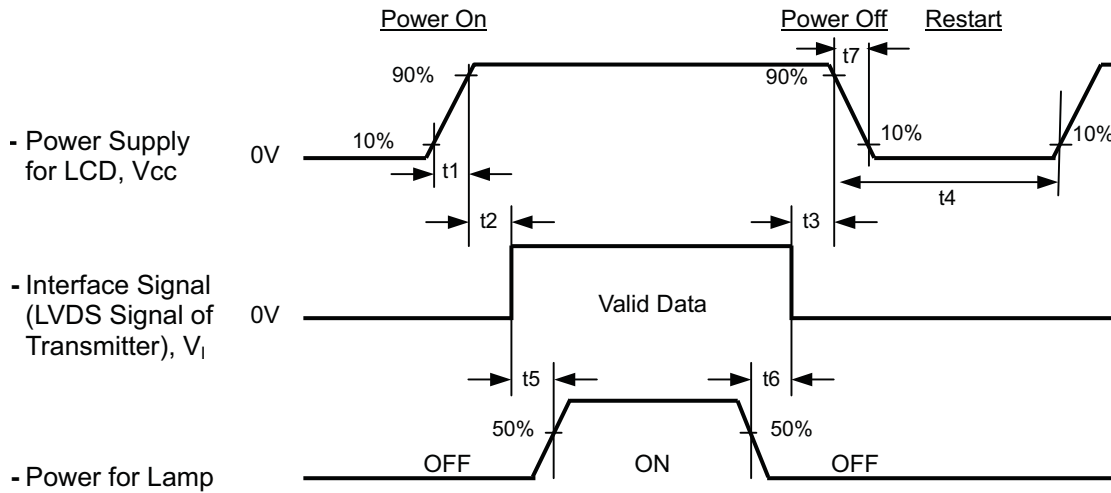
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	-	71	80	MHz	-
DE	Vertical Total Time	TV	810	823	1000	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1360	1440	1600	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

- $0.5 < t_1 \leq 10 \text{ msec}$
- $0 < t_2 \leq 50 \text{ msec}$
- $0 < t_3 \leq 50 \text{ msec}$
- $t_4 \geq 500 \text{ msec}$
- $t_5 \geq 200 \text{ msec}$
- $t_6 \geq 200 \text{ msec}$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD V_{cc} to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the V_{cc} falling time had better to follow

$$t_7 \geq 5 \text{ msec}$$

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

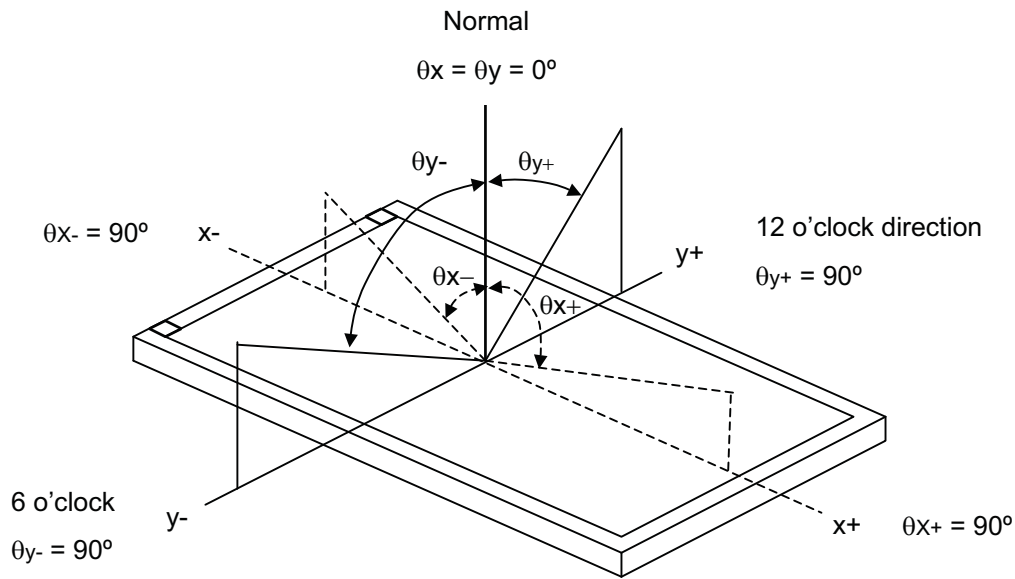
Item	Symbol	Value	Unit
Ambient Temperature	T _a	25±2	°C
Ambient Humidity	H _a	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	6.0	mA
Inverter Driving Frequency	F _L	55	KHz
Inverter	Sumida-H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	280	400	-	-	(2), (5)
Response Time		T _R		-	5	10	ms	(3)
		T _F		-	11	16	ms	
Central Luminance of White		L _C		170	200		cd/m ²	(4), (6)
Average Luminance of White		L _{AVE}		155	185	-	cd/m ²	
Color Chromaticity	Red	R _x		TYP. -0.03	0.602	TYP. +0.03	-	(1)
		R _y			0.340		-	
	Green	G _x			0.306		-	
		G _y			0.521		-	
	Blue	B _x			0.151		-	
		B _y	0.120		-			
	White	W _x	0.313		-			
		W _y	0.329		-			
	Color Gamut		C.G.	42	45		%	(7)
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45	-	Deg.	(1),(5)
		θ_x-		40	45	-		
	Vertical	θ_Y+		15	20	-		
		θ_Y-		40	45	-		
White Variation of 5 Points		δW _{5p}	$\theta_x=0^\circ, \theta_Y=0^\circ$ (BM-5A)	80	-	-	%	(5),(6)
White Variation of 13 Points		δW _{13p}	65	-	-	%		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

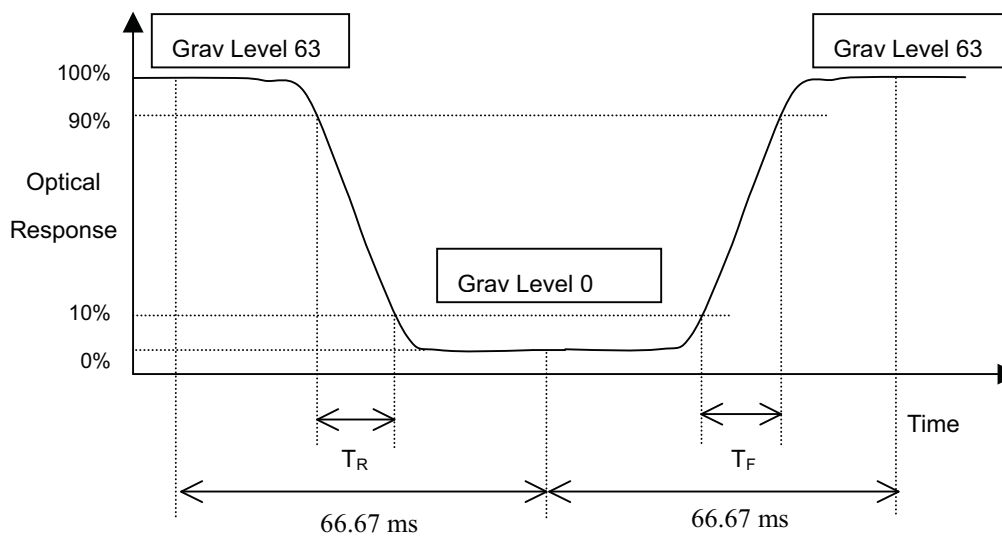
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$CR = CR(5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

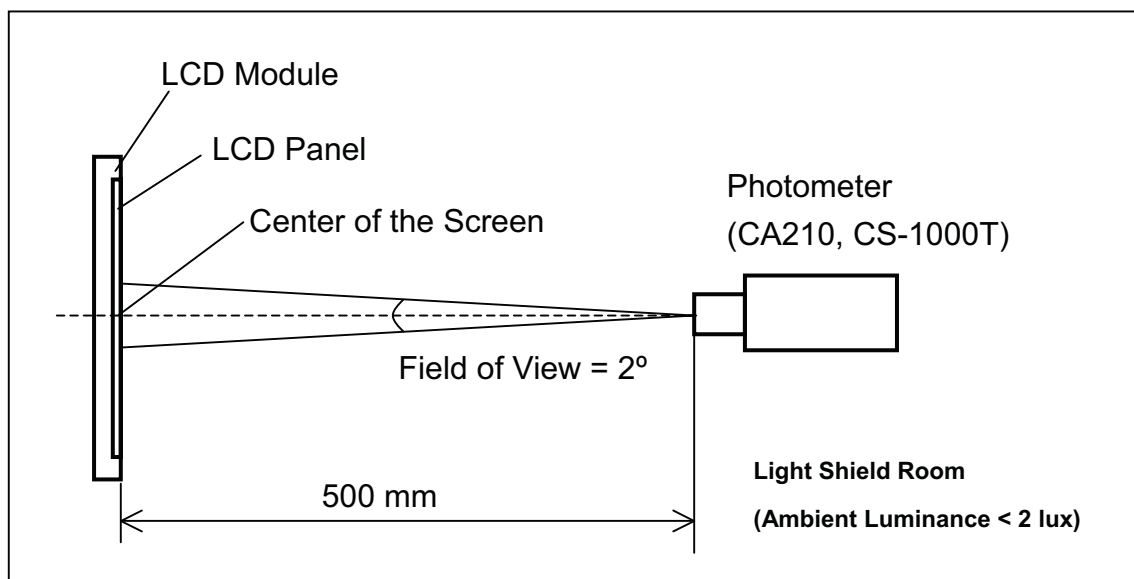
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

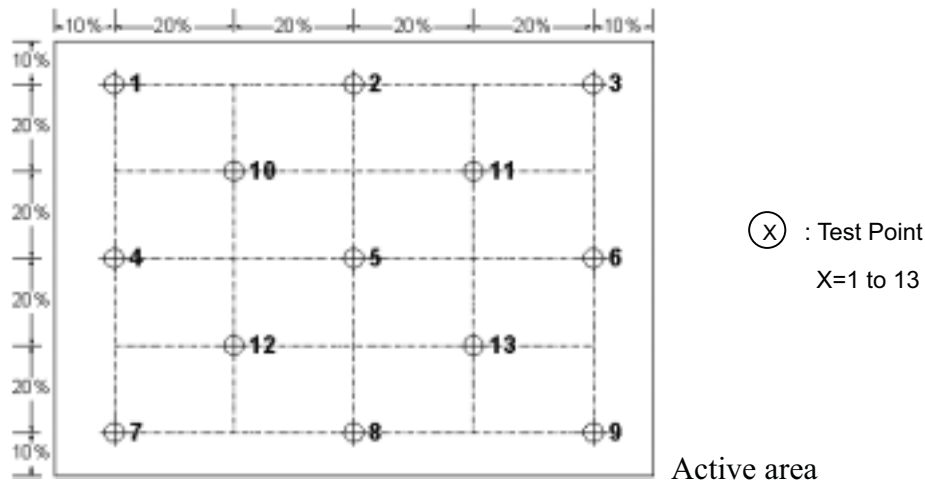


Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \text{Minimum} [L(10) + L(11) + L(12) + L(13) + L(5)] / \text{Maximum} [L(10) + L(11) + L(12) + L(13) + L(5)]$$

$$\delta W_{13p} = \text{Minimum} [L(1) \sim L(13)] / \text{Maximum} [L(1) \sim L(13)]$$



Note (7) Definition of color gamut (C.G%):

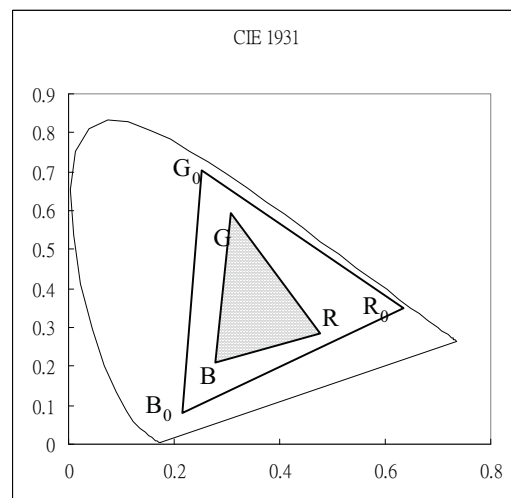
$$C.G\% = R G B / R_0 G_0 B_0 \cdot 100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$R G B$: area of triangle defined by R, G, B



8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

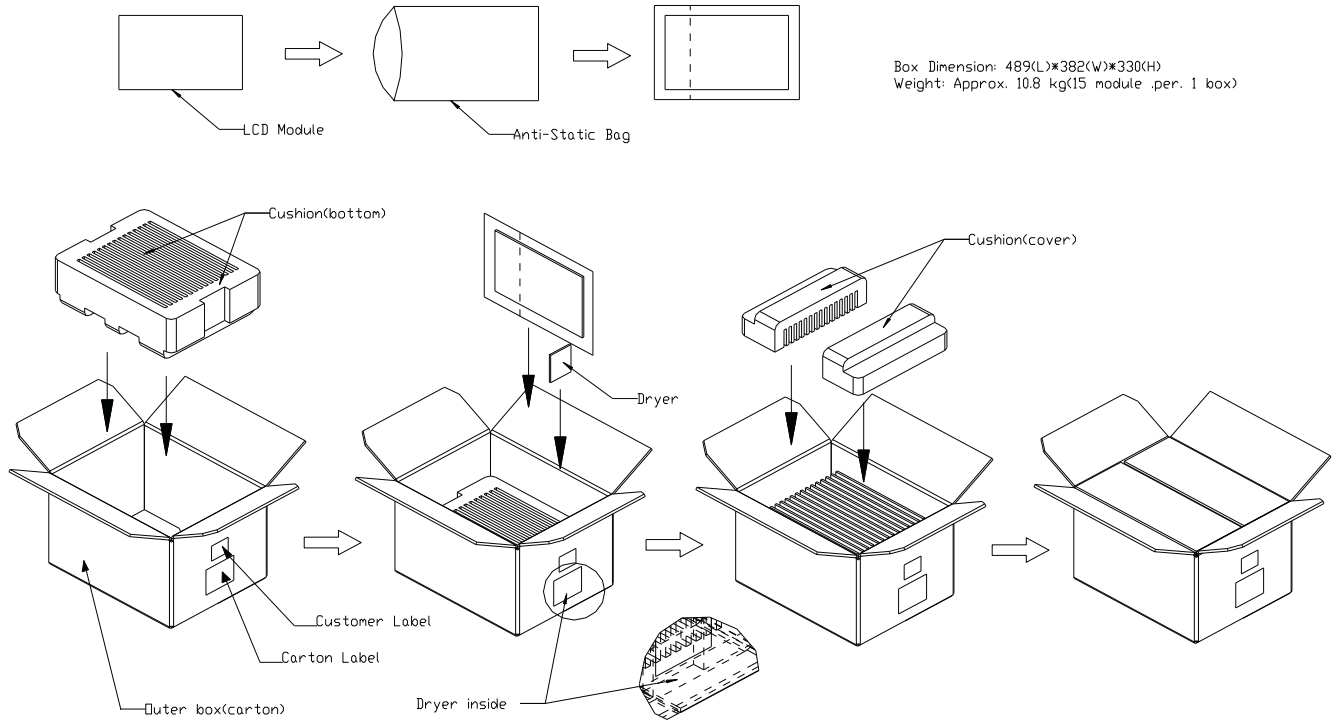
- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

9. PACKING

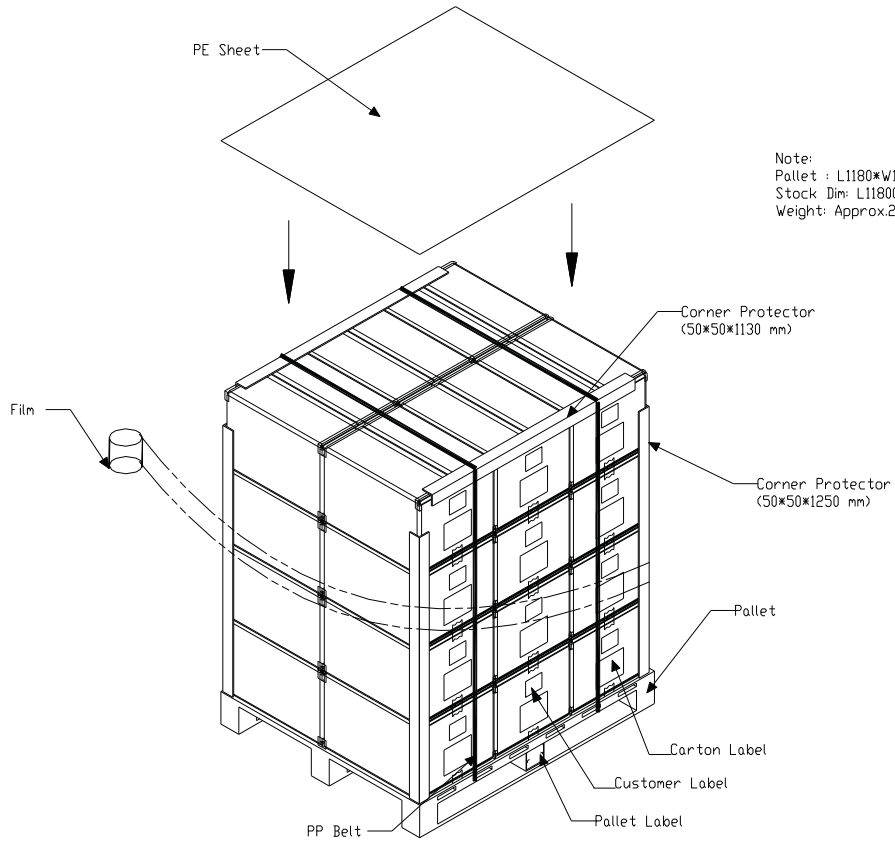
9.1 CARTON



Packing testing criteria :

- (1) Packing drop : 1 corner, 3 edges, 6 faces, each direction for one time, follow ISTA standard.
- (2) Packing vibration : Random, follow ISTA standard.

9.2 PALLET



10. DEFINITION OF LABELS

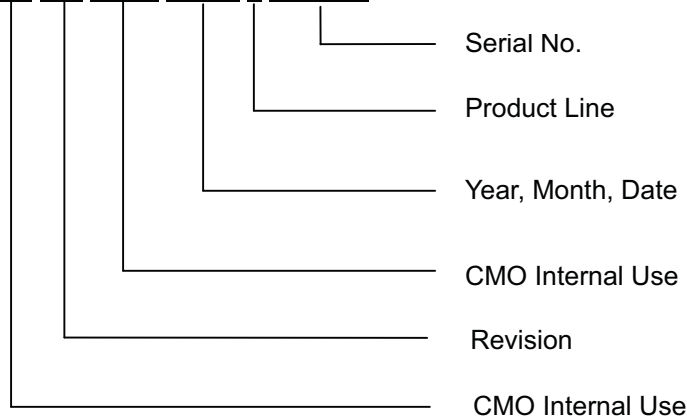
10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: LQ154K1LB1B

(b) Serial ID: XXXXXXYMDLNNNN



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10.2 CARTON LABEL

PO.NO.	_____
Part ID.	_____
Model Name	N154I2 -L02
Carton ID.	_____ Quantities _____
Made in XXXXX	

The barcode nameplate is pasted on each carton as illustration, and its definitions are as following explanation.

- (a) Model Name: N154I2-L02
- (b) Carton ID. : Packing sequence of product
- (c) Quantity: Total shipping quantity by the order

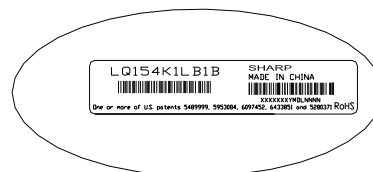
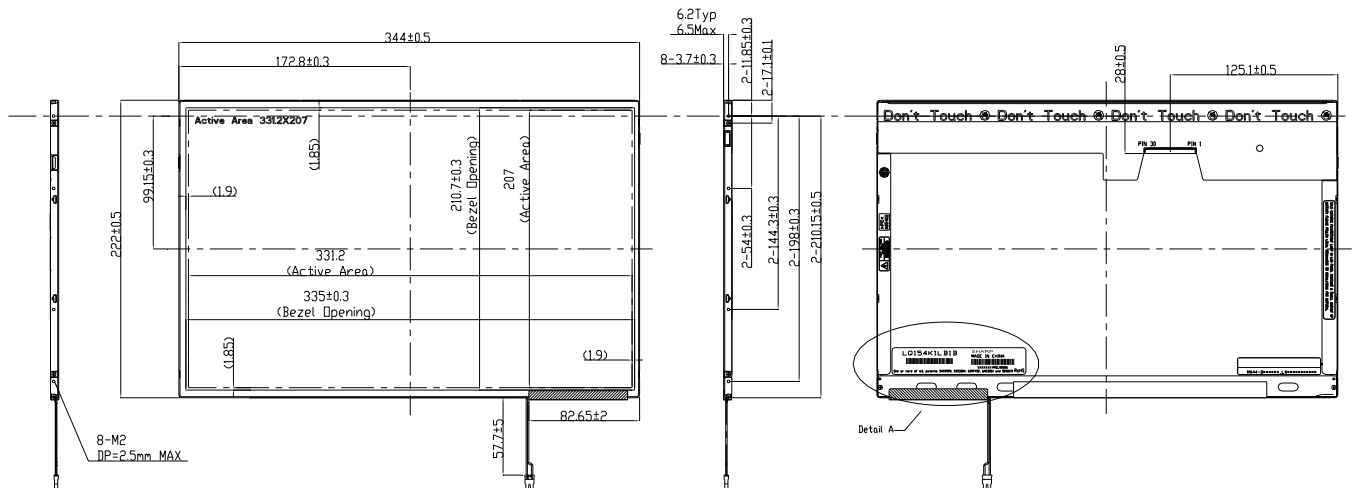
Model No. :	4S LQ154K1LB1B
	
LotNO. :	1T 2006.06.26
	
Quantity :	Q 15 pcs
	
Rev. No. :	
LQ154K1LB1B (CM)	

Another barcode nameplate is pasted on each carton as illustration, and its definitions are as following explanation.

- (d) Model No: LQ154K1LB1B (Sharp Model Number)
- (e) Lot No. : Packing date
- (f) Quantity: Total shipping quantity by the order

NOTE:

1. GENERAL TOLERANCE : $\pm 0.5\text{mm}$
2. THE SCREW TORQUE FOR MOUNTING SHALL NOT EXCEED $2.0\text{kgf}\cdot\text{cm}$ (0.196N·m).
3. THE GAP BETWEEN THE PANEL AND THE BEZEL IS 0.5mm MAX.
4. SIGNAL INTERFACE CONNECTOR : FI-XB30SRL-HF11(JAE)
5. CCFL CONNECTOR : BHSR-02VS-1(JST)



Detail A
SCALE 2:1